SCIENTIFIC OCEAN DRILLING

State of the Art, Globally Ranging Drilling Vessel in Support of Scientific Ocean Drilling

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Exploring Earth by Scientific Ocean Drilling

Abstract

- Analysis of cores and geophysical data collected by scientific ocean drilling during the past 50 years have yielded valuable insight into first-order questions about how our planet works.

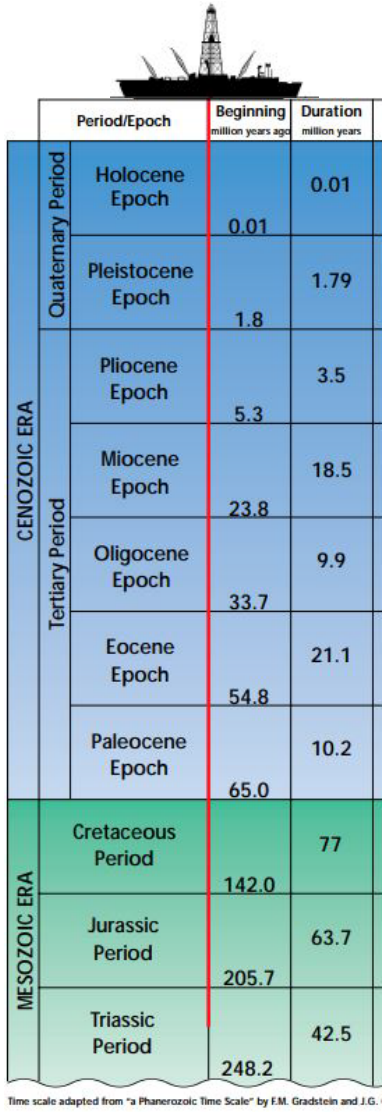
- Based on this collective knowledge, we are now are poised to launch a new era of international research to test scientific paradigms and hypotheses that inform issues of particular relevance or interest to society*. **A new globally ranging drilling vessel equipped with state-of-the-art drilling, coring, logging and analytical capabilities is vital to address these complex and emerging challenges**.

* Koppers, A.A.P., and R. Coggon, eds. 2020. Exploring Earth by Scientific Ocean Drilling: 2050 Science Framework. 124 pp., https://doi.org/10.6075/J0W66J9H

Great Discoveries

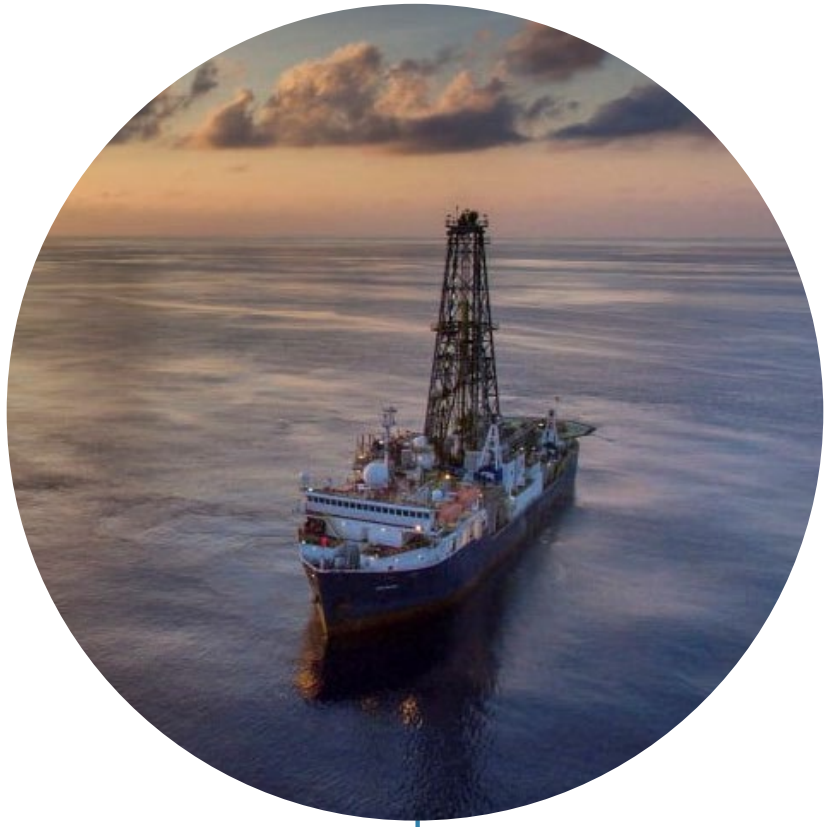
Samples recovered by scientific ocean drilling tell us about Earth processes over the last 250 million years.
Some of the highest profile discoveries include:

- Records of the apocalypse: Drilling the Chicxulub impact crater – *Extraterrestrial Impacts and Mass Extinctions*
- ~100-million-year history of the timing, rates, and estimated amplitudes of *Global Sea Level Change*
- *Icehouse and Greenhouse Cycles* – Palm trees at the poles
- *The Moving Plates of our Planet* – defining the fundamentals of how the Earth works
- Long-term borehole monitoring systems– *Evaluating Earthquake and Tsunami Hazards and Deep Biosphere Processes*
- From DEBI-t to SHERLOC, Earth to Mars, IODP to NASA – *Technological Development for Sampling Microbial Life* in extreme environments



"... arguably the most successful international research collaboration ever."

[Nature, 25 September 2013]



The U.S. is at a crossroads with an ageing and outdated seafloor coring infrastructure.

Impacts

The United States has been the world's leader in directing an international approach to scientific ocean drilling for the past five decades.

Beyond fundamental and transformational discoveries of Earth processes, scientific ocean drilling:

- *Supports* a STEM workforce across the U.S.;
- *Provides* a firm foundation for a blue economy;
- *Investigates* natural geohazards and their potential impact on society;
- *Develops* cross-cutting technology for sampling and monitoring; and
- *Promotes* diversity, equity, and inclusion through outreach and international engagement.

Challenges

Ocean Decade Challenges - Through a truly global, multi-disciplinary research program, scientific ocean drilling will contribute to three UN Decade Challenges

- *Challenge 2:*

  Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to monitor, protect, manage and restore ecosystems and their biodiversity under changing environmental, social and climate conditions.

  - *Assess magnitudes, rates, and impacts of climate change on a variety of timescales and ecosystems*

- *Challenge 5:*

  Enhance understanding of the ocean-climate nexus and generate knowledge and solutions to mitigate, adapt and build resilience to the effects of climate across all geographies and at all scales, and to improve services including predictions for the ocean, climate and weather.

  - *Test models of sea level rise, ocean circulation, and general ocean health*

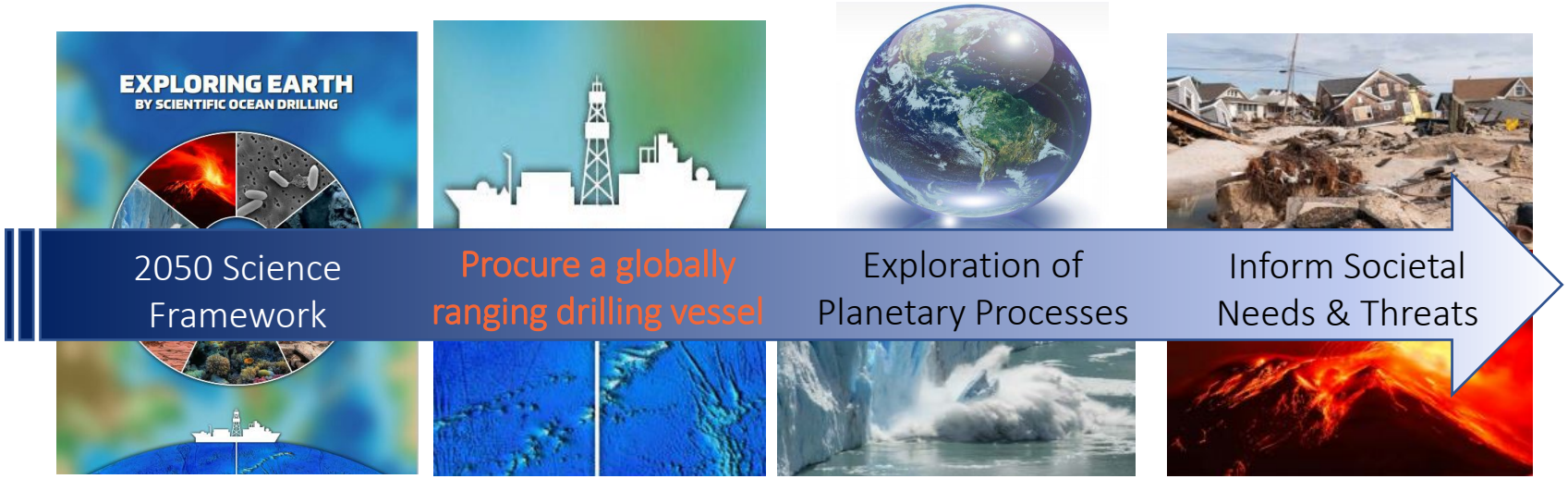
- *Challenge 9:*

  Ensure comprehensive capacity development and equitable access to data, information, knowledge and technology across all aspects of ocean science and for stakeholders.

  - *Generate FAIR (findable, accessible, interoperable and reusable) data and accessible technologies*

Vision

- *Develop* a multi-decadal overarching Science Framework* - *completed*
- *Procure* a new state-of-the-art globally ranging drilling vessel – *our Ocean Shot*
- *Explore* fundamental connections among Earth system processes
- *Increase* Earth and planetary science literacy by communicating those insights to policymakers, communities at threat, educators and the wider public



Our vision is to provide critical insights into Earth processes through global collaborative efforts, and use those insights for the benefit of society, sustainability and protection of marine resources.

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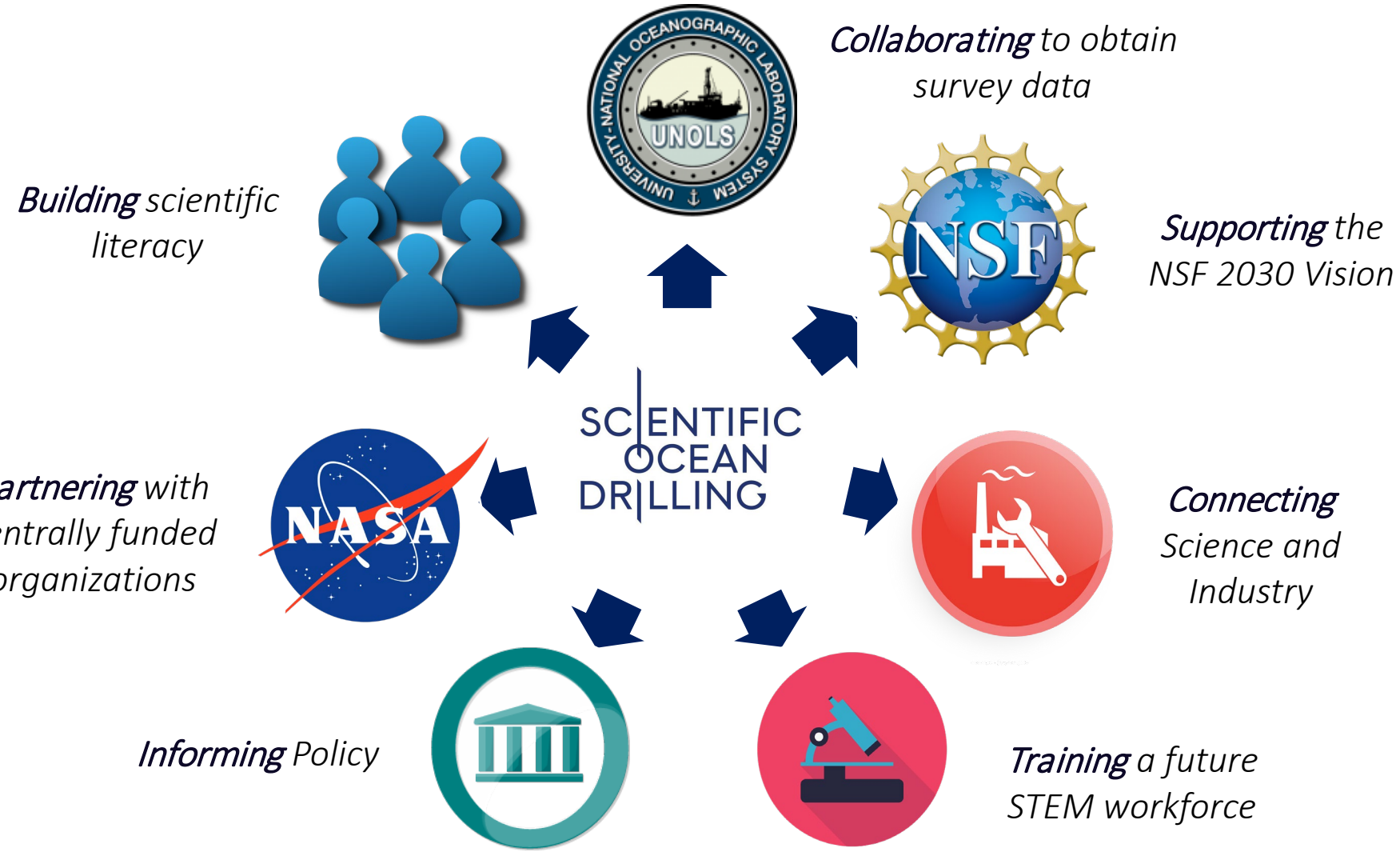
Connections



Collaborating *to obtain survey data*

Supporting *the NSF 2030 Vision*

Connecting *Science and Industry*

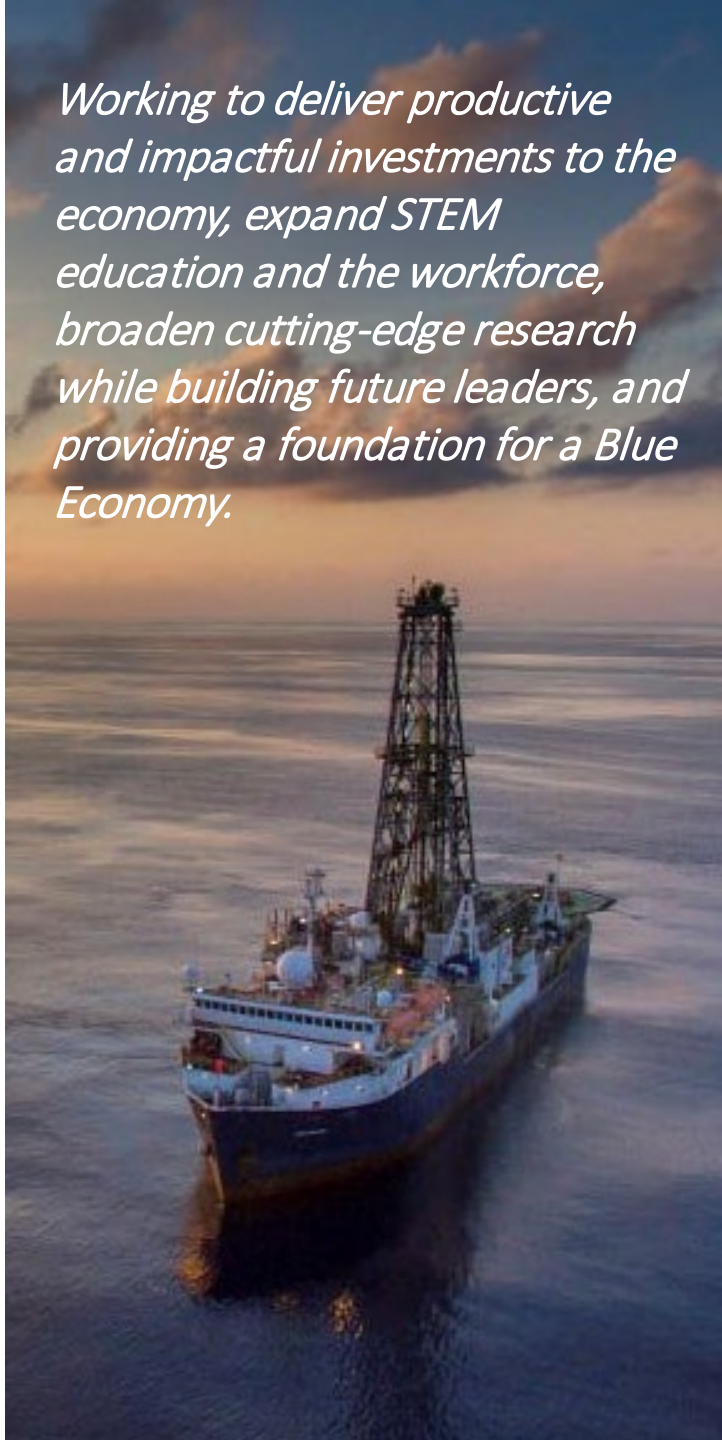
Training *a future STEM workforce*

Informing *Policy*

Partnering *with centrally funded organizations*

Building *scientific literacy*

Working to deliver productive and impactful investments to the economy, expand STEM education and the workforce, broaden cutting-edge research while building future leaders, and providing a foundation for a Blue Economy.



Capacity Building

Mentoring by senior scientists

Inclusion of graduate students as science party members

Scientific advances through *international collaboration*

Diversity of careers, backgrounds and skill sets

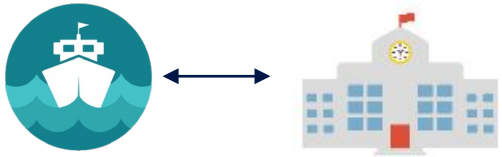
SCIENTIFIC OCEAN DRILLING

Pushing technological boundaries through research and development

Inspiring STEM educators and students

Educational projects that use scientific ocean drilling data and samples

Active science through ship-to-shore sessions



A new vessel will be a natural training ground for the next generation of ocean researchers and an incubator for collaborative science.

2050 Science Framework

A new state-of-the-art, globally ranging scientific drillship will allow the US to lead fundamental geoscience research and capitalize on the globalization of science and engineering into the future.

- *2050 Science Framework**

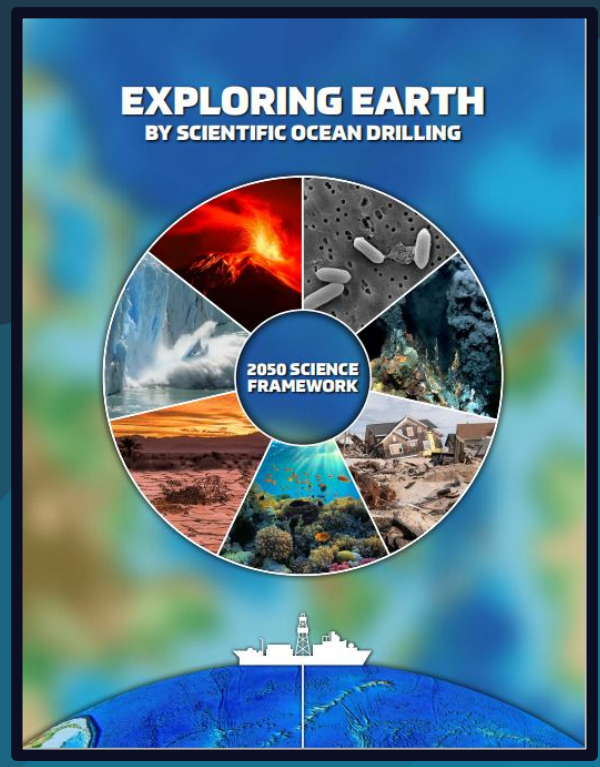
  A 25-year outlook, inspiring state-of-the-art approaches for scientific ocean drilling far into the mid-21st century, that was developed by international scientists and embraced by NSF.

- *NSF Dear Colleague Letter*

  Received expressions of interest for a multi-decadal drilling vessel as the current supported vessel, *JOIDES Resolution*, reaches the end of its service life.

- *Science Mission Requirements Workshop*

  Requested by NSF and organized by the U. S. Science Support Program, seeking input from the US community on scientific priorities, equipment, technology, and lab facility needs for a future US-operated drilling vessel.



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